INSTRUCTION MANUAL

#2

THE SONA-SWEEP

RETURN TO
ELECTRONIC SCIENCES
LIBRARY

ISSUED BY
BOEING AIRPLANE COMPANY
ENGINEERING FILE - LIBRARY
TO Physical Research DATE 3-31-54 ISSUE NO #3
LIBRARY FILE NO. D2C 192-2

KAY ELECTRIC COMPANY

14 Maple Ave., Pine Brook, N. J.

RETURN TO
ELECTRONICS SCIENCES
LIBRARY

Instruction Manual

THE SONA-SWEEP

Table of Contents

		Page
Section I	Description	1
II	Features	1
III	General Circuit Description	3
IV	Description of Controls	4
V	Operating Instructions	5
Schematic Diagram, Main Unit		7
Parts List, Main Unit		8
Block Diagram		10
Cable Connections		11
Power Supply Schematic Diagram		13
Parts List, Power Supply		14

Section I: Description

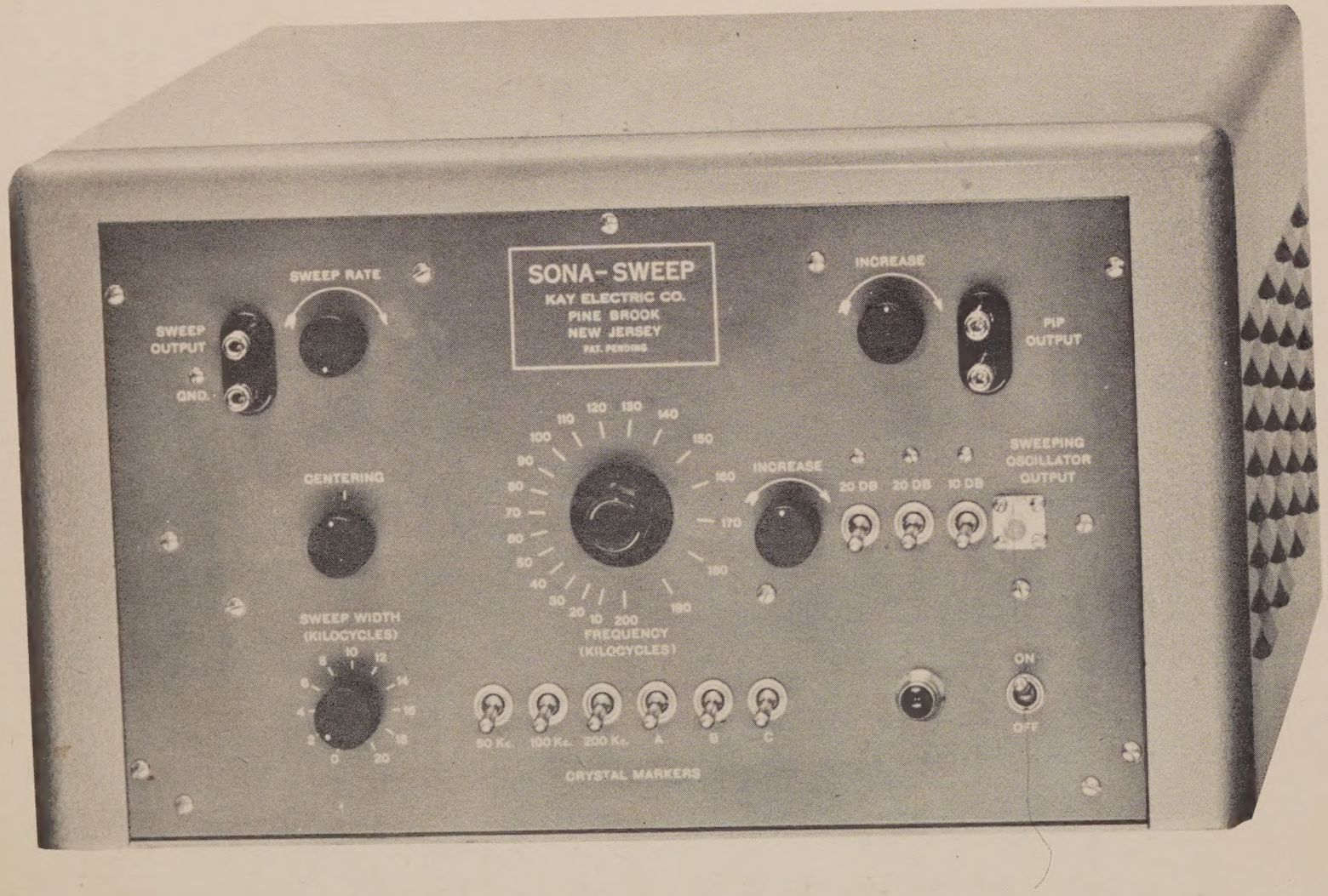
The Sona-Sweep is a narrow-band sweeping oscillator designed for use with an oscilloscope in defining the pass band characteristics of amplifiers and filters. It provides a narrow frequency sweep which can be centered at frequencies from 10 to 200 kilocycles. The Sona-Sweep develops marker pips which are independent of the amplifier circuits under test.

Section II: Features

The Sona-Sweep produces a linearly swept signal about a center frequency which may be set anywhere between 10 to 200 kilocycles. The sweep width can be varied continuously from zero to 20 kilocycles. The sweep system is all electronic with the swept oscillator being frequency modulated by varying the permeability of the coil. The sweep signal is a symmetrical sawtooth, the negative going time interval being utilized to disable the sweeping oscillator and produce a bright zero level baseline on the oscilloscope display.

All markers are crystal-positioned and of the pulse type, being fed directly to the vertical terminals of the oscilloscope. Markers of this type are completely independent of the circuit under test, and neither cause overloading during alignment nor disappear in regions of low amplification. The mark level is adjusted by an independent control, which allows setting convenient mark heights regardless of the level of the frequency response display.

The Sona-Sweep is carefully isolated from its own electronic regulated power supply as well as from the power line source. A shield box completely encloses the RF unit, independent of the cabinet.



THE SONA-SWEEP

The basic circuits of the Sona-Sweep (Schematic Diagram, Fig. 1) are shown in simplified block diagram in Fig. 2. In addition to a regulated power supply, they are comprised of:

1. Sawtooth generator
2. 2.0 to 2.2 mc. sweeping oscillator
3. 2.0 to 2.2 mc. isolation amplifier
4. 2 mc. crystal oscillator
5. 2 mc. isolation amplifier
6. Mixer
7. Low pass filter 0 to 200 kc.
8. Variable attenuator
9. Crystal filters
10. Detector
11. Trigger amplifier
12. Pip generator

The 2.0 to 2.2 mc. sweeping oscillator employs a 12 AT7 (V8) and utilizes a variable permeability technique. The oscillator is frequency-modulated by an amplified sawtooth voltage generated in a 6AS6 (VI) multivibrator circuit. This sawtooth voltage is used not only to develop the frequency sweep but also to provide time base voltage for the horizontal axis of the oscilloscope. Thus, by connecting the horizontal axis amplifier of the oscilloscope to the SWEEP OUT terminals of the Sona-Sweep, all phasing difficulties are avoided. The sweep rate can be varied from approximately 6 to 60 cycles.

A 2 mc. crystal oscillator consisting of a cathode coupled 12AT7 (V3) is provided as the local oscillator against which the 2.0 to 2.2 mc. sweeping oscillator beats. Each of these individual oscillators is decoupled through individual buffer amplifiers (V4 and V5). Such amplifiers minimize the lock-in frequency and maintain the low frequency output down to 10 kc.

A balanced ring modulator produces the desired heterodyned output from 10 to 200 kc. A low pass filter, 0 to 2 mc., serves to attenuate the 10 to 12 mc. output which would otherwise also be present. A double potentiometer continuously variable attenuator and also 20 db and 10 db step attenuators are provided.

In developing the marker "pips", signals from the 2.0 to 2.2 mc. sweeping oscillator are fed into crystal filters cut to 10.5, 11.0 and 12 mc. These crystal filters thus produce pips at an output frequency of 0.5, 1.0 and 2.0 mc. Three

additional crystal marker jacks are provided for additional markers.

The trigger voltage from the crystal filters is amplified and used to trigger the pip generator, V7.

Section IV: Description of Controls

A. Panel Controls and Connectors

1. ON-OFF Toggle Switch (S1) is the power switch in the primary of the power transformer.

2. Pilot Light (I1) is lighted when power is on.

3. FREQUENCY (C14) is the tuning condenser which sets the sweeping oscillator frequency. This dial is calibrated to read output frequency.

4. CENTERING is a potentiometer control (R13) which allows precise alignment of the crystal pips with the dial markings.

5. SWEEP OUT terminals J1 make available the sawtooth sweeping voltage for connection to the horizontal terminals of the test oscilloscope.

6. SWEEP RATE control (R4) allows variation of the repetition rate of the sawtooth.

7. PIP OUTPUT terminals make available the pulse type marker signals for connection directly to the vertical terminals of the test oscilloscope.

8. PIP INCREASE control allows adjustment of the voltage level of the marker pips between zero and approximately 50 volts peak (positive).

9. SWEEPING OSCILLATOR OUTPUT is the output terminal of the sawtooth swept RF. A maximum voltage of approximately 0.5 volt RMS at a 70 ohm output impedance level.

10. SWEEP WIDTH adjusts the frequency excursion of the sweeping oscillator.

11. Switched Attenuators 20 db, 20 db and 10 db.

12. Continuous attenuator, a double potentiometer, R 58 A & B, which will reduce the voltage by another 15 db approximately.

B. Chassis Controls

1. Trigger adjustment potentiometer (R44) which is reached through a hole on the right hand side of the cabinet (looking from the front). This potentiometer adjusts the imput trigger to the pip-forming multivibrator. If this control is set too far counterclockwise, no pips

may be seen. If set too far clockwise, then distorted or multiple-firing pips may be seen. The controls should be set midway in the range of operation.

Section V: Operating Instructions

A. Plug the power cord into a source of 105-125 volt AC at 50-60 cycles. Turn the Sona-Sweep on and allow 5 to 10 minutes for stabilization.

B. Make cable connections as follows (note Figs. 3, 4):

1. Connect 70 ohm output cable (with BNC connectors) between SWEEPING OSCILLATOR OUTPUT Terminal and amplifier under test. It is usually good test practice to terminate this cable in 70 ohms.

2. Connect SWEEP OUT terminals to the horizontal amplifier terminals of oscilloscope. Either shielded or unshielded lead may be used.

3. Connect PIP OUTPUT terminals to vertical amplifier terminals of oscilloscope. Shielded lead is recommended. It is often advisable to connect a 10,000 ohm resistor in series with this lead right at the oscilloscope. The need for the isolation can be determined later by observing the effect on the displayed response of connecting and disconnecting this pip output lead. Change in shape of response curve indicates the desirability of isolation, whereas mere change in level is unimportant.

4. Output of amplifier must be detected usually before mixing with pip output at vertical amplifier terminals of oscilloscope. See Fig. 4. The only time that such detection is unnecessary is when the oscilloscope vertical amplifier has a pass band wide enough to include that of the amplifier under test. See Fig. 3.

5. Note that such a wide variety of output impedances and gain variations is found in typical amplifiers that it is not possible to consider all possible test setups. Thus Fig. 3 is merely a guide. Sometimes it may be necessary to terminate the amplifier and also compensate for the input capacitance of the oscilloscope which is used.

C. Operation

1. After connection as described, adjust attenuator controls and gain of vertical axis amplifier of oscilloscope until response curve is obtained on oscilloscope.

2. Adjust SWEEP RATE control until oscilloscope pattern is stationary.

3. Adjust PIP OUTPUT control until pips are of convenient height.

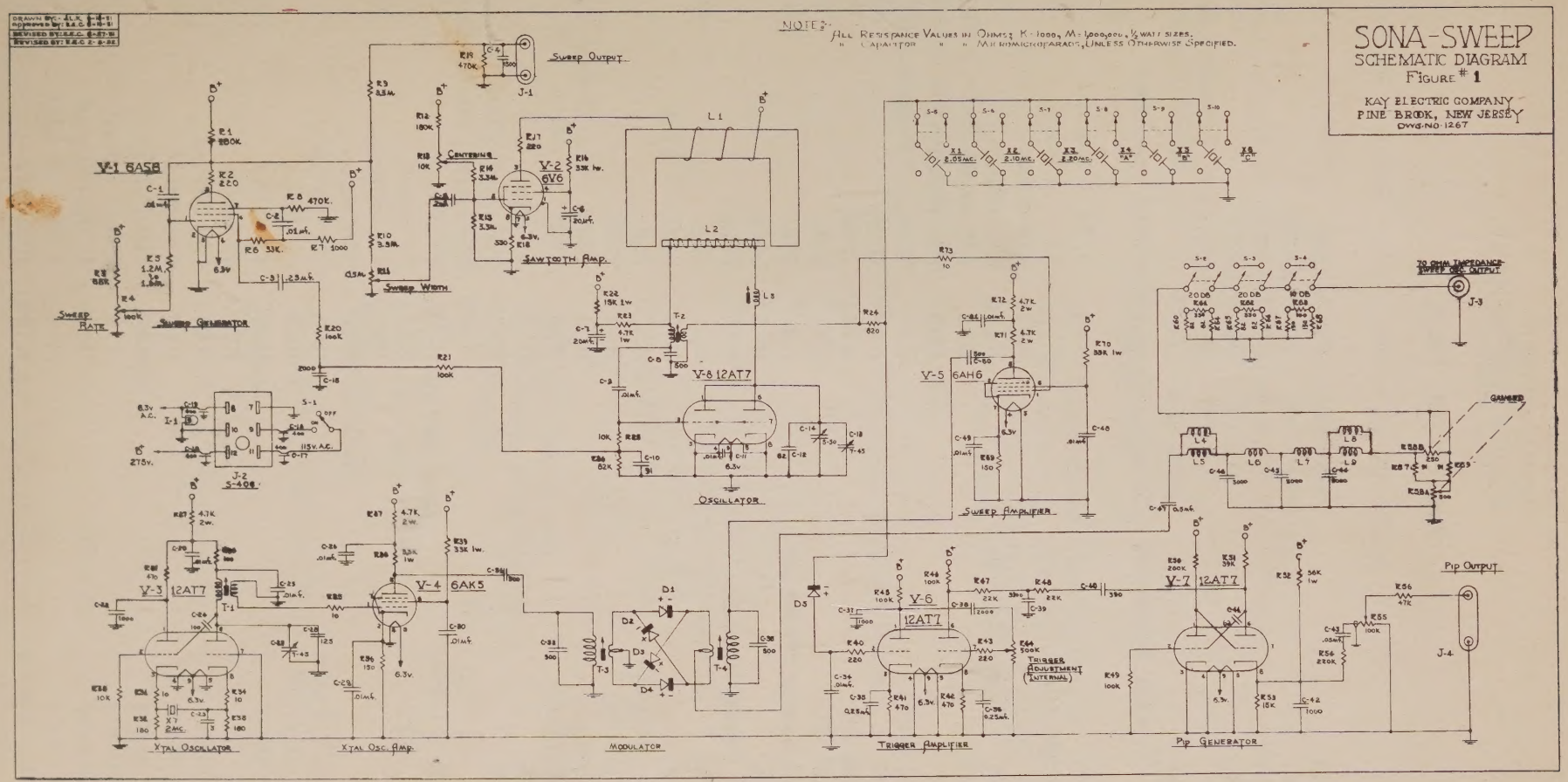
4. Select desired CRYSTAL MARKERS by means of toggle switches 1 to 6. As set up in the standard Sona-Sweep unit the following frequencies will be found:

CRYSTAL MARKER Front Panel	FREQUENCY PIP
1	50.0 kc.
2	100.0 kc.
3	200.0 kc.
A	Spare
B	Spare
C	Spare

Other special crystals may be substituted in any of the above positions.

5. Note that the three standard Crystal Markers, 50.0 kc., 100.0 kc., and 200.0 kc. provide accurate check points against which the dial may be calibrated.

The CENTERING control is very useful for aligning the dial reading with the crystal check point.


DRAWN BY: A.L.K. 6-14-51
APPROVED BY: R.A.C. 6-15-51
REVISED BY: R.A.C. 6-27-51
REVISED BY: R.A.C. 2-8-55
NOTE: ALL RESISTANCE VALUES IN OHMS; K=1000, M=1,000,000, ½ WATT SIZES.
" CAPACITOR " " MICROMICROFARADS, UNLESS OTHERWISE SPECIFIED.
SONA-SWEEP
SCHEMATIC DIAGRAM
FIGURE # 1
KAY ELECTRIC COMPANY
PINE BROOK, NEW JERSEY
DWG. NO. 1267
V-1 6AS8
V-2 6V6
SAWTOOTH AMP.
SWEEP OUTPUT
J-1
SWEEP WIDTH
SWEEP RATE
SWEEP GENERATOR
L1
L2
L3
V-8 12AT7
OSCILLATOR
V-5 6AH6
SWEEP AMPLIFIER
70 OHM IMPEDANCE SWEEP OSC. OUTPUT
J-3
GRIDDED
S-1
S-409
J-2
V-3 12AT7
T-1
XTAL OSCILLATOR
V-4 6AK5
XTAL OSC. AMP.
MODULATOR
V-6 12AT7
TRIGGER AMPLIFIER
TRIGGER ADJUSTMENT (LATE RNAS.)
V-7 12AT7
PIP GENERATOR
PIP OUTPUT
J-4

SONA-SWEEP
PARTS LIST

(February 8, 1952)

Tubes

V1 6AS6
V2 6V6
V3 12AT7
V4 6AK5
V5 6AH6
V6 12AT7
V7 12AT7
V8 12AT7

Resistors

*All Resistors 1/2 watt unless otherwise specified

R1 180K
R2 200 ohms
R3 68K
R4 100K - Sweep Rate pot.
R5 1.2M to 1.8M
R6 33K
R7 1000 ohms
R8 470K
R9 3.3M
R10 3.3M
R11 500K Sweep Width pot.
R12 180K
R13 10K Centering pot.
R14 3.3M
R15 3.3M
R16 33K - 1 watt
R17 220 ohms
R18 330 ohms
R19 470K ohms
R20 100K
R21 100K
R22 15K - 1 watt
R23 4.7K - 1 watt
R24 820 ohms
R25 10K
R26 82K
R27 4.7K - 2 watt
R28 100 ohms
R29 470 ohms
R30 10K
R31 10 ohms
R32 180 ohms
R33 180 ohms
R34 10 ohms
R35 10 ohms
R36 150 ohms
R37 4.7K - 2 watt
R38 3.3K - 1 watt
R39 33k - 1 watt
R40 220 ohms
R41 470 ohms
R42 470 ohms
R43 220 ohms
R44 500K - Trigger Adj. (Internal)
R45 100K
R46 100K
R47 22K
R48 22K
R49 100K
R50 200K
R51 39K
R52 56K - 1 watt
R53 15K
R54 220K
R55 100K - Pip Output pot.
R56 47K
R57 91 ohms
R58A 500 ohms)Dual Ganged continuous
R58B 250 ohms)Attenuation pots.
R59 91 ohms
R60 82 ohms
R61 330 ohms
R62 330 ohms
R63 100 ohms
R64 82 ohms
R65 82 ohms
R66 82 ohms
R67 130 ohms
R68 130 ohms
R69 150 ohms
R70 33K - 1 watt
R71 4.7K - 2 watt
R72 4.7K - 2 watt
R73 10 ohms

PARTS LIST

Capacitors

* All voltage ratings are 450V unless otherwise specified

C1	.01 mf
C2	.01 mf
C3	0.25 mf
C4	1500 mmf
C5	2 mf - Oil Bath
C6	20 mf - Electrolytic
C7	20 mf - "
C8	500 mmf
C9	.01 mf
C10	91 mmf
C11	.01 mf
C12	62 mmf
C13	7 to 45 mmf - patter
C14	5 to 50 mmf - Tuning Cond.
C15	2000 mmf
C16	400 mmf
C17	400 mmf
C18	400 mmf
C19	400 mmf
C20	.01 mf
C21	.01 mf
C22	1000 mmf
C23	3 mmf
C24	100 mf
C25	.01 mf
C26	.01 mf
C27	7 to 45 md - patter
C28	125 mf
C29	.01 mf
C30	.01 mf
C31	500 mmf
C32	500 mmf
C33	500 mmf
C34	.01 mf
C35	.25 mf
C36	.25 mf
C37	1000 mmf
C38	2000 mmf
C39	3300 mmf
C40	390 mmf
C41	62 mmf
C42	1000 mf
C43	.05 mf
C44	5000 mmf
C45	5000 mmf
C46	5000 mmf
C47	0.5 mf
C48	.01 mf
C49	.01 mf
C50	500 mmf

Connectors

J-1 - Gen. Radio - Sweep Output
J-2 - Jones Plug - #S-406-Power Cable
J-3 - I.P.C. - Sweep Osc. Output
J-4 - Gen. Radio - Pip Output

Crystals

D1 - KP705 Germanium Diode)
D2 - " " ") Balanced
D3 - " " ") Modulator
D4 - " " ")
D5 - " " "

X1 to 6 - 3rd Mode Low impedance, series resonant modes in HC-6 cases, quartz crystals

X7 - quartz X'tal - X'tal oscillator

Coils

L1 - Oscillator coil
L2 Output coupling coil
L3 Special " "
L4 " " "
L5 Special coil
L 6 to 9 - Special coils

Transformers

T- 1, 2, 3 & 4 Special X'Formers

Lamps

I-1 GE #47 Bayonet Type

Switches

S1- S.P.D.T. - ON-OFF Line Switch

S2-3 & 4 D.P.D.T. - Attenuation Switches
S5 to 10 - D.P.D.T. - Pip ON-OFF Switches

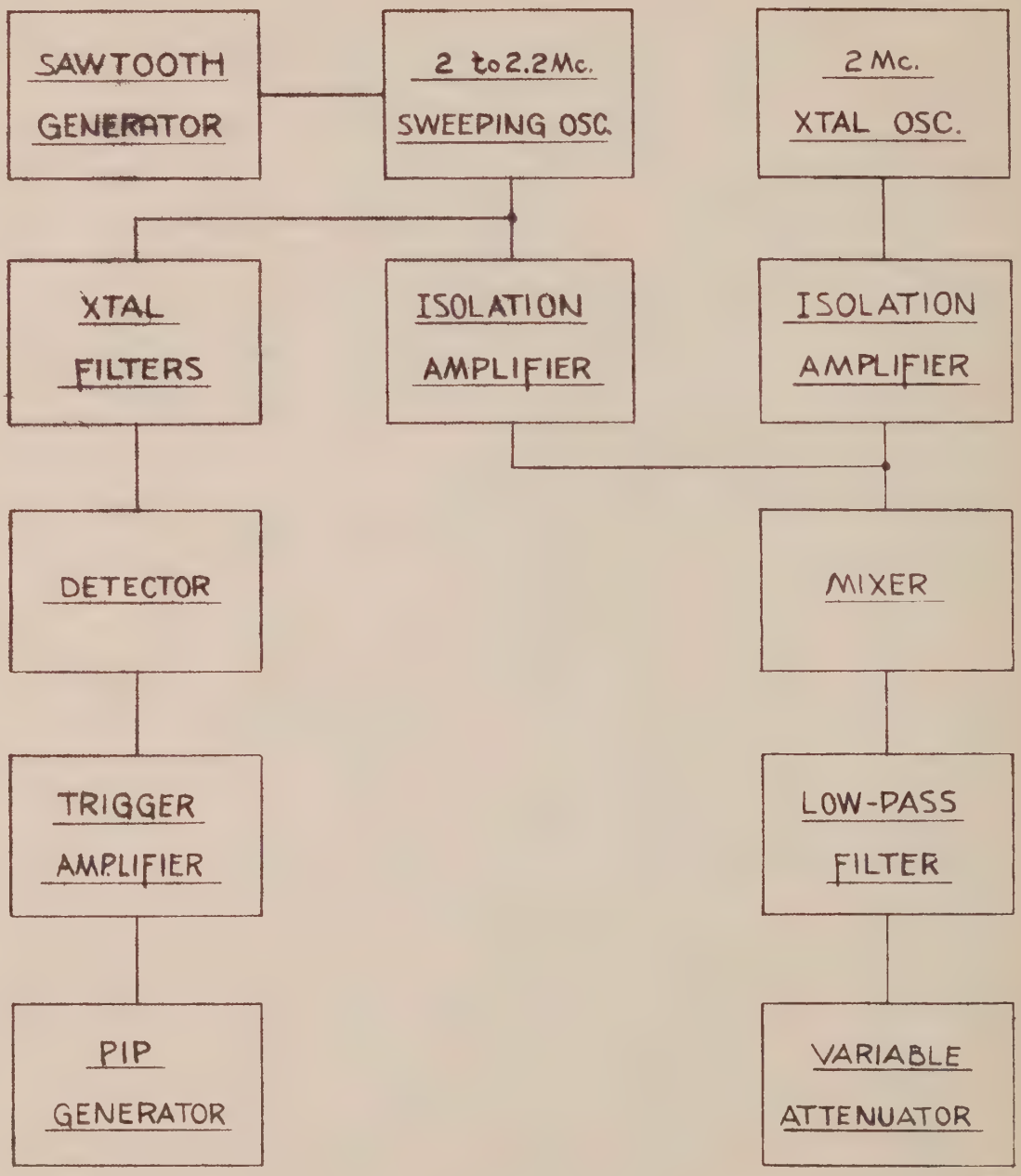
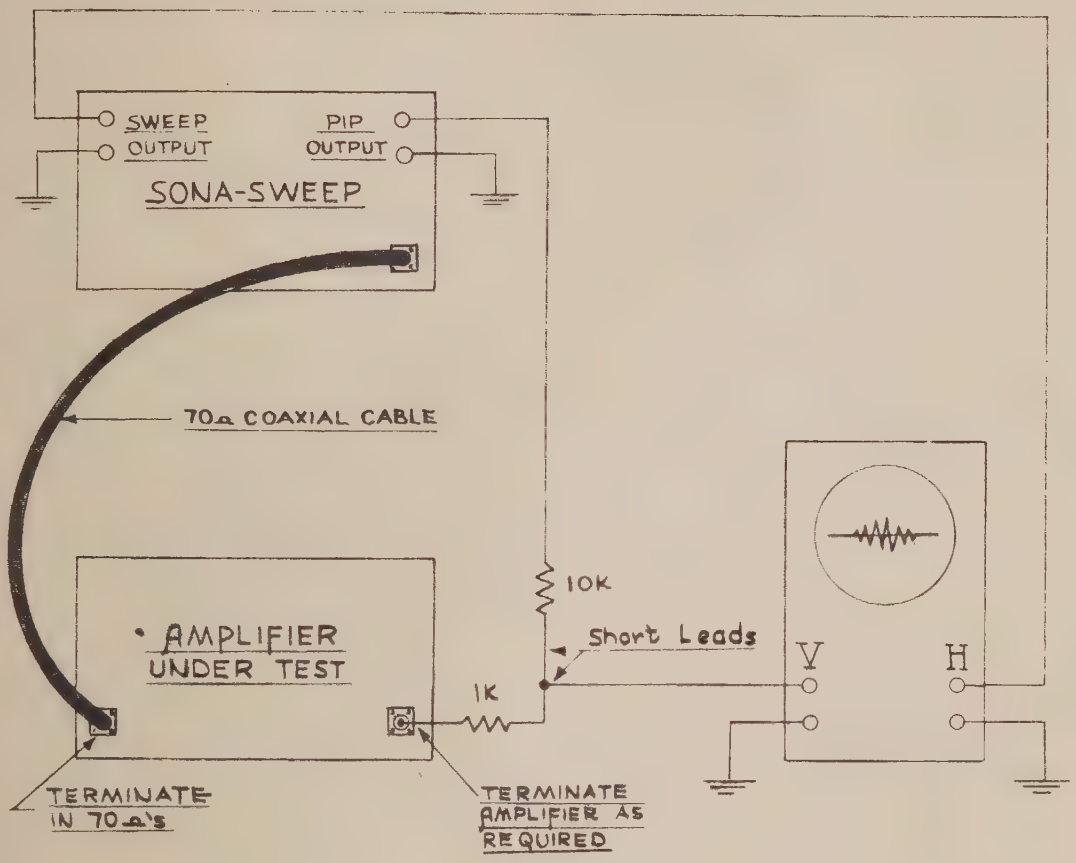


Fig. 2

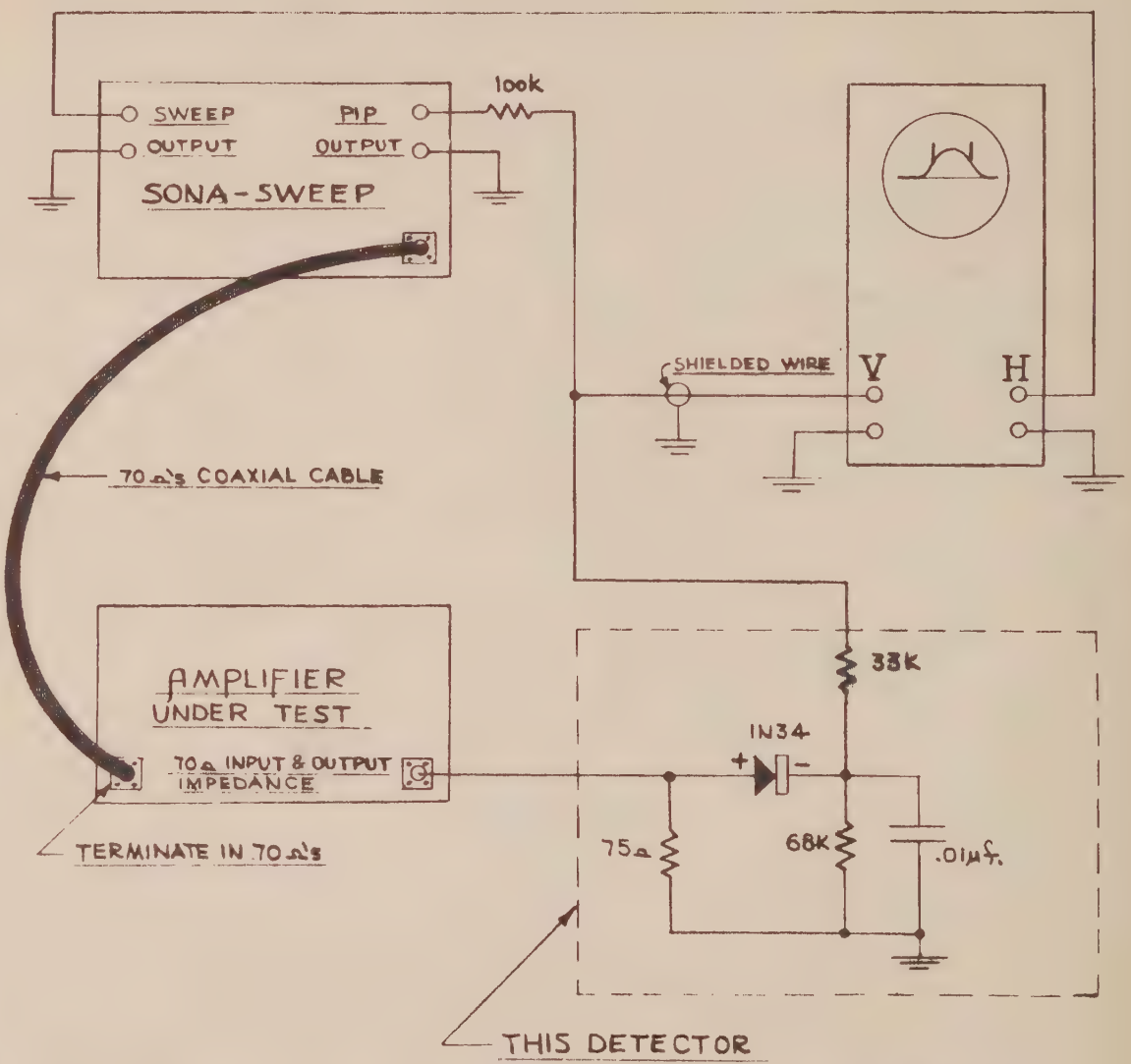
SONA-SWEEP BLOCK DIAGRAM



IF A WIDE BAND OSCILLOSCOPE IS AVAILABLE, NO DETECTOR IS NECESSARY.

FIG. 3

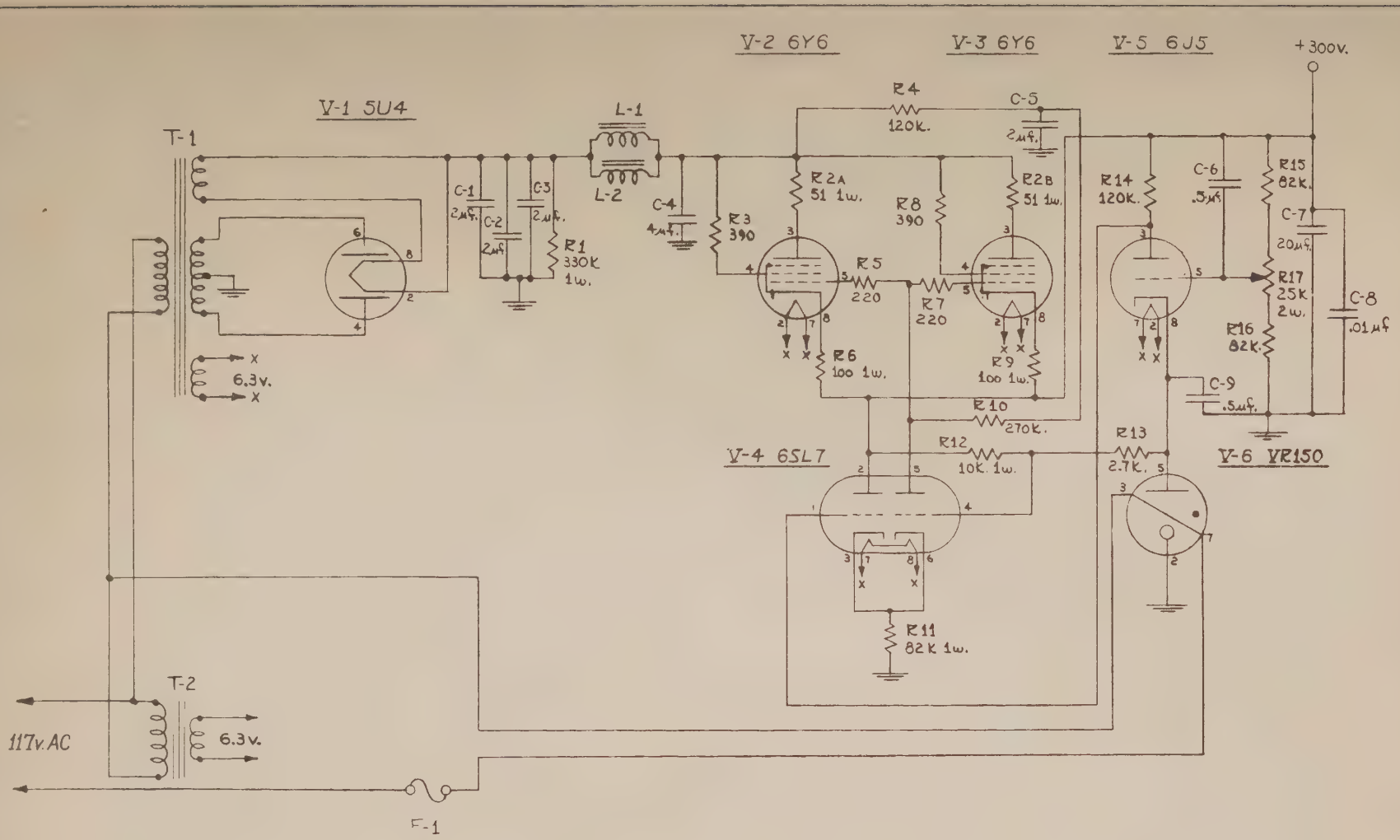
SONA-SWEEP CABLE CONNECTIONS



MAY ALSO BE USED TO CHECK OUTPUT OF THE SONA-SWEEP

Fig. 4

SONA-SWEEP CABLE CONNECTIONS



POWER SUPPLY

SCHEMATIC DIAGRAM of MODEL 123

KAY ELECTRIC COMPANY
PINE BROOK, NEW JERSEY

DRN. BY: J.K. DATE: 2-8-52
APPD. BY: G DATE: 2-11-52

DWG. No. 1214-A

PARTS LIST

(Revised 2/8/52)
for

POWER SUPPLY

Tubes

V1	5U4	V4	6SL7 or 6SU7
V2	6Y6	V5	6J5
V3	6Y6	V6	VR150

Resistors

R1	330K - 1 watt
R2A	51 - 1 watt
R2B	390 - 1 watt
R3	390 - 1/2 watt
R4	120K - 1/2 watt
R5	220 = 1/2 watt
R6	100 - 1 watt
R7	220 - 1/2 watt
R8	390 - 1/2 watt
R9	100 - 1 watt
R10	270K - 1/2 watt
R11	82K - 1 watt
R12	10K - 1 watt
R13	2.7K - 1/2 watt
R14	120K - 1/2 watt
R15	82K - 1/2 watt
R16	82K - 1/2 watt
R17	25K - 2 watt-TYPE "J" Pot.

Chokes

L-1 10 Henry, 270 ohms - 0.1 Amps.
L-2 10 Henry, 270 ohms - 0.1 Amps.

Fuse

F-1 3 Amps.

Condensers

C1	2mf 600 v.
C2	2mf 600 v.
C3	2mf 600 v.
C4	4mf 600 v.
C5	2mf 600 v.
C6	0.5 mf 600 v.
C7	20-20mf 450 v.
C8	.01mf 500 v.
C9	0.5 mf 600 v.

Transformers

T-1 KP91 - Industrial
T-2 KF65 - Industrial

19007